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ROAD VEHICLE LOCATING SYSTEM

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(56) Prior Art Documents
US 4651157
EP 242099
EP 123562

(57) Claim

1. A locating or surveillance system for monitoring the instantaneous position of a mobile object at a central monitoring station, in which the system comprises:

a receiving system to be located at the central monitoring station;

a navigation unit to be located on the mobile object and operable automatically to determine the position of the object by reference to orbiting navigational satellites or by reference to land based transmission or receiving beacons; and

a cellular telephone transmitter unit to be located on the mobile unit and connected to the navigation unit, the transmitter unit being operable to transmit signals receivable by the receiving system at the central monitoring station and indicative of the instantaneous position of the object as determined by the navigation unit, in which the mobile unit comprises a navigational system operable to send positional data, in either serial or parallel format, to an interface unit which takes the data and translates it by means of a dual tone multi frequency tones, prior to sending the data onwards to a cellular telephone.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

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SA 09015

This annex lists the patent family members relating to the patent documents cited in the annex mentioned international search report. The members are as contained in the European Patent Office's list of prior art documents. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family members	Publication date
EP-A- 0240199	21-10-87	EP-A- 63024095	01-02-88
FR-A- 2541801	31-03-84	None	
US-A- 4536933	24-06-86	None	
US-A- 4651156	17-03-87	CA-A- 1217341	07-02-87
EP-A- 0109255	09-10-86	None	
EP-A- 0120562	31-10-84	None	
US-A- 4651157	17-03-87	None	

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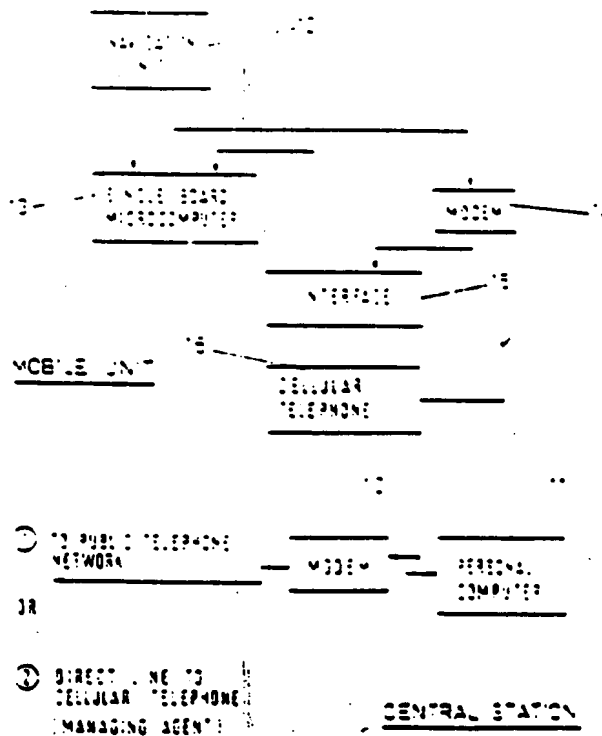
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(54) Title: ROAD VEHICLE LOCATING SYSTEM

(57) Abstract

There is disclosed a locating or surveillance system for monitoring the instantaneous position of a mobile object, such as a truck, at a central monitoring or base station. The system comprises a receiving system (10, 11) to be located at the central monitoring station, a navigation unit (12) to be located on the mobile object and operable automatically to determine the position of the object by reference to orbiting navigation satellites or by reference to land based transmissions or receiving beacons, and a radio telephone type transmitter unit (16) to be located on the mobile unit and connected to the navigation unit (12), the transmitter unit being operable to transmit signals which will be received by the receiving system (10, 11) at the central monitoring station and which are indicative of the instantaneous position of the mobile object as determined by the navigation unit (12).



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ROAD VEHICLE LOCATING SYSTEM

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This invention relates to a locating system which enables the location of a mobile object to be monitored on a continuous or intermittent basis at a central monitoring station.

The invention has been developed primarily, though not exclusively, in connection with the surveillance of cars and trucks, though it should be understood that the system of the invention is also applicable generally to the surveillance of mobile objects.

The value of loads carried by trucks can reach very substantial amounts, and it is not unusual for loads of, say, £500,000 to be borne on the public highway on a single vehicle, and to this should be added a typical cost of a heavy duty truck to perhaps £50,000 to £60,000. These figures apply to relatively ordinary items of goods, though of course with high intrinsic value goods, such as bullion or payroll

cash is involved, very much higher figures can be involved.

There are in existence surveillance systems for monitoring the location of vehicles, these systems employing small radio "bugs" which can be attached to a vehicle, and which issue a radio signal to be picked-up by a following surveillance
5 vehicle. However, the range of these devices is limited, typically up to about 50 miles, and of course requires the provision of a following surveillance vehicle. There is also a "line of sight" communication system, known as PINPOINT, which operates from fixed observation positions, and may or may not utilise "dead reckoning". Various types of CB radio systems are known also, but they are limited in distances.

10 It is also documented to provide navigation systems for boats, such as the Decca Navigation system, which can provide automatic indication of the instantaneous position of a boat, in latitude and longitude, by use of signals from land based beacons or orbiting navigational satellites. However, these navigational systems only give a visual indication of the position of the boat on a screen, or may
15 incorporate a printer unit to provide a printout.

It has also been taught to link cellular radio telephone systems, which operate via satellites into the normal telephone system. One such cellular radio telephone system is Cellnet, which is gaining wide acceptance for use in cars.

The present invention has been developed primarily with a view to provide
20 a locating or surveillance system which enables the position of mobile objects, such as cars or trucks, to be monitored from a central monitoring station using a telephone receiving system at the central station, and an automatic navigation system and a radio transmission system on board the mobile object for transmitting signals to be received by the central station which will be indicative of the instantaneous
25 position of the object.

According to one aspect of the invention there is provided a locating or surveillance system for monitoring the instantaneous position of a mobile object at a central monitoring station, in which the system comprises:

- a receiving system to be located at the central monitoring station;
- 30 a navigation unit to be located on the mobile object and operable automatically to determine the position of the object by reference to orbiting navigational satellites or by reference to land based transmission or receiving

beacons; and

a cellular telephone transmitter unit to be located on the mobile unit and connected to the navigation unit, the transmitter unit being operable to transmit signals receivable by the receiving system at the central monitoring station and indicative of the instantaneous position of the object as determined by the navigation unit, in which the mobile unit comprises a navigational system operable to send positional data, in either serial or parallel format, to an interface unit which takes the data and translates it by means of a dual tone multi frequency tones, prior to sending the data onwards to a cellular telephone.

Thus, in use of the system, the positional co-ordinates of the object can be kept under continuous or intermittent surveillance, as desired, at the central monitoring station, and the range of surveillance is only limited by the territory within which radio telephonic communication is possible.

The navigation unit may be generally of the type used for marine navigation, and one preferred form is known as Navstar, manufactured by Polytechnic Electronics, and which is able to give extremely accurate positional indications in longitude and latitude, by reference to orbital navigational satellites or land based beacons.

It is preferred that the system should be designed to operate via the Cellnet radio telephone system, and the receiving system at the monitoring station is designed to be connected to the public telephone, or by direct line to a "cellular telephone".

The unit mounted on the mobile object may include a telephone handset, though the position interrogation via the central station may take place without operation of the handset. Indeed, for customers who do not require a telephone handset to be available to the driver or occupants of the mobile object usually a truck the components of the unit may be mounted in concealed positions, so that surveillance can take place without the knowledge of the driver or the occupants.

The mobile unit preferably comprises a navigational system which sends data transmission of positional data (in either serial or parallel format) to an interface unit which takes the serial/parallel data and translates it to a DTMF (dual tone multi frequency) toner, prior to sending the data onwards to a "cellular telephone".

The cellular telephone may be provided with an interface unit if required, modified to automatically answer an incoming call, either by software or hardware changes. The complementary receiving unit at the central monitoring station may comprise a DTMF interface unit (which may be similar to the interface unit provided on the
5 mobile unit), and which is connected to the public telephone network or by a direct line to a "cellular telephone" operating as a managing agent. The central station unit also includes a personal computer or the like which is connected to the DTMF for the transmission therebetween of serial/parallel data, and provides running communications, with suitable software. The receiving unit is designed to be able
10 to call up the allocated number of the mobile object, and there is then fed automatically positional data, updated at desired intervals as obtainable by the navigation unit, e.g. every 7 seconds, or other period as required. The central station may also include a compact disc read only memory (CD ROM) or other system holding copies of ordinance survey maps (or other specified maps) for the UK or
15 other countries in which the system is required. Software will be provided which will take the positional data, and from it command the system to find which ordinance survey map that refers to and displays on screen, with optional hard copy output.

It is envisaged that the locating or surveillance system according to the invention will be of particular value in the monitoring of the transit of high value
20 loads, as well as of vehicles. When the on board transmitting units are suitably concealed, the movement can be tracked at the remote central station, whether the vehicle is being operated by authorised or unauthorised personnel. The accuracy of positional data which can be achieved by existing marine navigational units is of a very high order, and vehicle positions can be determined with an accuracy within 50
25 yards.

By use of the system, stolen vehicles can be readily tracked, and this will be of great assistance to any organisations seeking to recover stolen vehicles and stolen loads.

The system is therefore believed to be of great potential to police and
30 surveillance authorities, as well as haulage contractors and large companies operating fleets of delivery vehicles.

Embodiments of surveillance system according to the invention will now be

described in detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of an embodiment of a surveillance system according to the invention; and,

5 Figure 2 is a block diagram of a modified mobile unit of another embodiment of the invention.

Referring to Figure 1 of the drawings, there is disclosed a locating or surveillance system which enables the position of mobile objects, such as cars or trucks, to be monitored from a central monitoring station using a receiving system
10 at the central station, and an automatic navigation system and a transmission system on board the mobile object for transmitting signals to be received at the central station and which will be indicative of the instantaneous position of the object.

At the central station, it will be possible to dial the number allocated to the mobile object e.g. a truck which is to be under surveillance, and this then initiates
15 an automatic response via a cellular telephonic link from position data determined by a navigation unit provided on board the vehicle.

The mobile unit is provided with a navigation unit 12, which is operable automatically to determine the positional co-ordinates of the truck by reference to orbiting navigation satellites (or to land based transmitting or receiving beacons), and
20 preferably takes the form of the navigational unit known as Navstar, which is made by Polytechnic Electronics. A radio cellular telephone transmitter unit is also provided on the mobile unit and is connected to the navigation unit 12, the transmitter unit being operable to transmit signals receivable by the receiving system at the central monitoring station and indicative of the instantaneous position of the
25 object as determined by the navigation unit, given in terms of latitude and longitude. The unit further comprises an interface unit 17 arranged to receive data transmission of positional data in either serial or parallel format from the unit 12, and which takes this data and translates it to DTMF tones, prior to sending the data onwards to cellular telephone 18. The cellular telephone is modified to automatically answer
30 an incoming call, either by software or hardware changes.

It is not essential for the mobile unit to be provided with a telephone handset, in which case the components of the entire mobile unit may be mounted in a

concealed manner on the vehicle, so that secret surveillance can take place, whether the vehicle is being driven by authorised personnel or unauthorised personnel.

The complementary receiving unit at the central station comprises a DTMF interface unit 19, which may be similar to the interface 17 provided on the mobile unit, a personal computer 20 connected for transmission of serial/parallel data, and a line for connecting the DTMF to the public telephone network, or a direct line to the cellular telephone. The personal computer 20 may be a mini computer or main frame computer, and provided with running communications software and hard copy facility.

Although not shown, a modification to the central or base station may include a compact disc read only memory system (CD ROM), holding copies of ordinance survey maps for UK or other countries, and software which will take the positional data received and from it command the system to find which ordinance survey map that refers to and display on screen, with optional hard copy output.

Referring now to Figure 2 of the drawings, there is shown a modified arrangement for incorporation in the mobile unit to be provided on the mobile object whose location is to be monitored and surveilled. In this modified embodiment, a multi-functional interface 115 is provided, which is connected to a data generator 112 to receive data therefrom and which may comprise a suitable navigation unit. The interface 115 is also connected via its output to a cellular system 116, for onward transmission of positional data to the receiving system at the central monitoring station. In addition, the multifunctional interface 115 is coupled with a disabling unit 117, and the interface 115 may be arranged, upon receipt of a coded signal from the central monitoring station (which will be arranged not to be apparent to the driver of the vehicle) so as to cause automatic disabling of the mobile object, which may be a truck. The disabling unit may be coupled up with any suitable part of the vehicle to prevent its motion, such as a fuel switch-off device in a hidden position, or some means for automatically applying the brakes.

Thus, if it becomes apparent that the truck has been stolen, or is being driven by unauthorised personnel, a signal can be sent from the central monitoring station to be received by the mobile unit, and which disables the vehicle.

The multi-functional interface 115 therefore can have one or more of the

following capabilities:

- 1) it can function as a bi-directional data logger, which captures and transmits data from a navigation unit to be retransmitted to the base station via a radio type transmission system;
- 5 2) it may have encryption capability, or not, depending on whether this may be required;
- 3) it may have a facility for line protocol and error collection facilities;
- 4) it may incorporate a control unit which is capable of switching any handset which may be provided on or off, or can be used to disable
10 the vehicle via the disabling unit; and,
- 5) it functions as an interface between a cellular radio and a satellite system.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A locating or surveillance system for monitoring the instantaneous position of a mobile object at a central monitoring station, in which the system comprises:

a receiving system to be located at the central monitoring station;

a navigation unit to be located on the mobile object and operable automatically to determine the position of the object by reference to orbiting navigational satellites or by reference to land based transmission or receiving beacons; and

a cellular telephone transmitter unit to be located on the mobile unit and connected to the navigation unit, the transmitter unit being operable to transmit signals receivable by the receiving system at the central monitoring station and indicative of the instantaneous position of the object as determined by the navigation unit, in which the mobile unit comprises a navigational system operable to send positional data, in either serial or parallel format, to an interface unit which takes the data and translates it by means of a dual tone multi frequency tones, prior to sending the data onwards to a cellular telephone.

2. A system according to claim 1, in which the navigation unit is able to give accurate positional indications in longitude and latitude, by reference to orbital navigational satellites.

3. A system according to claim 1 or claim 2, in which the cellular telephone is provided with an interface unit modified to automatically answer an incoming call, either by software or hardware changes.

4. A system according to claim 3, including a complementary receiving unit to be arranged at the central monitoring station, and which comprises a dual tone multi frequency interface unit, and which is connectable to the public telephone network or by a direct line to a cellular telephone operating as a managing agent.

5. A system according to claim 4, in which the complementary receiving unit also includes a personal computer which is connected to the dual tone multi frequency interface unit for the transmission therebetween of serial/parallel data, and provides running communications with suitable software.

6. A system according to any one of the preceding claims further comprising a telephone hand set.

7. A system according to claim 6, in which the receiving system also includes a compact disc-read only memory (CD ROM) or other system for holding a map of the area in which the system is required.

8. A system according to any one of the preceding claims, in which a mobile unit to be provided on the mobile object includes a multi-functional interface arranged to capture and transmit data received from the navigation unit to the receiving system to be located at the central monitoring station, said multi-functional interface having one or more of the following capabilities:

- 1) encryption;
- 2) line protocol and error collection facilities;
- 3) function as a control unit to disable the mobile object on which it is to be provided;
- 4) act as an interface between a cellular radio and a satellite system.

9. A locating or surveillance system substantially as hereinbefore described with reference to the accompanying drawings.

DATED this 6th day of November 1992

Keith Chisholm Brown

By His Patent Attorneys

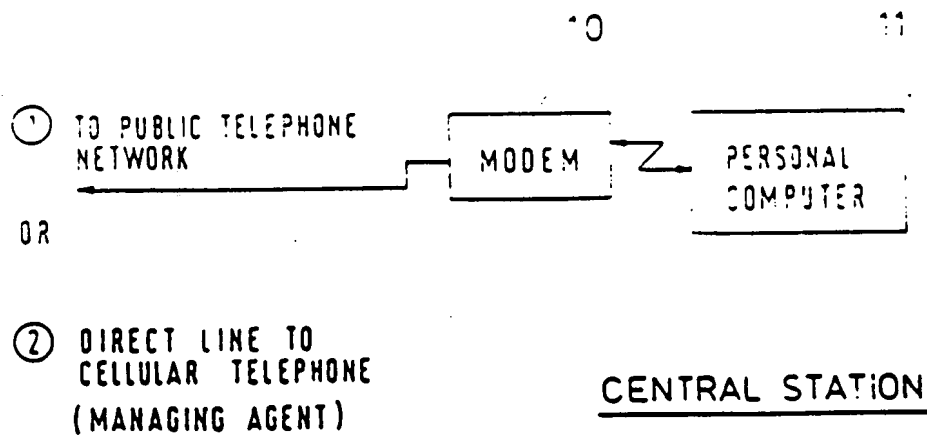
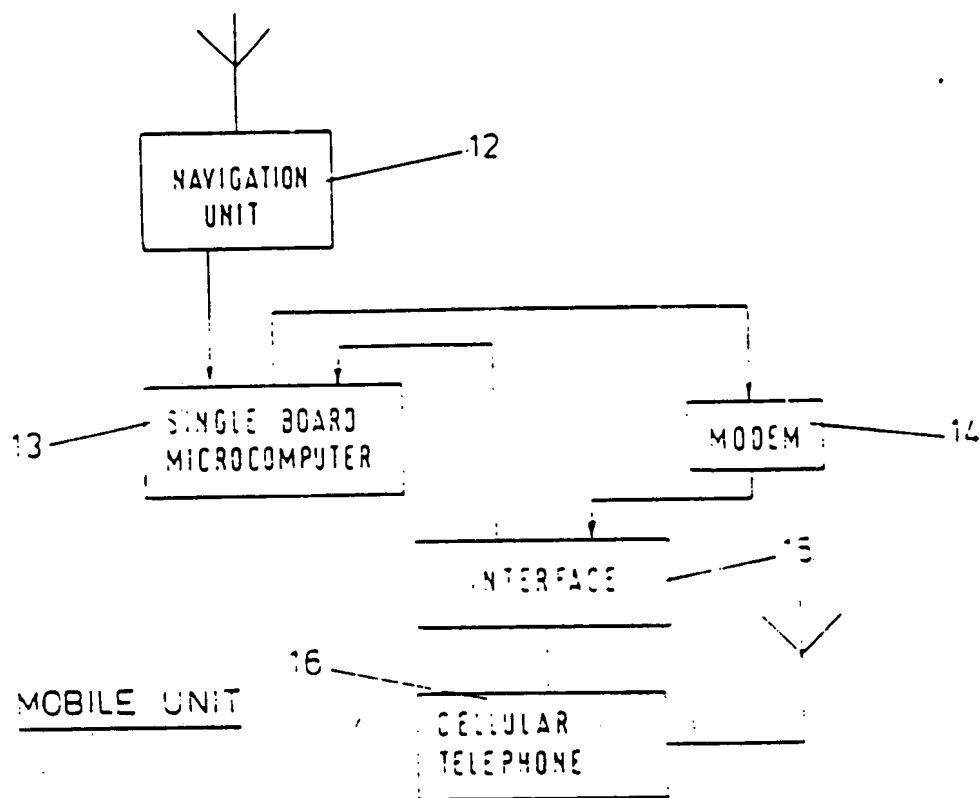
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WO 89/12835

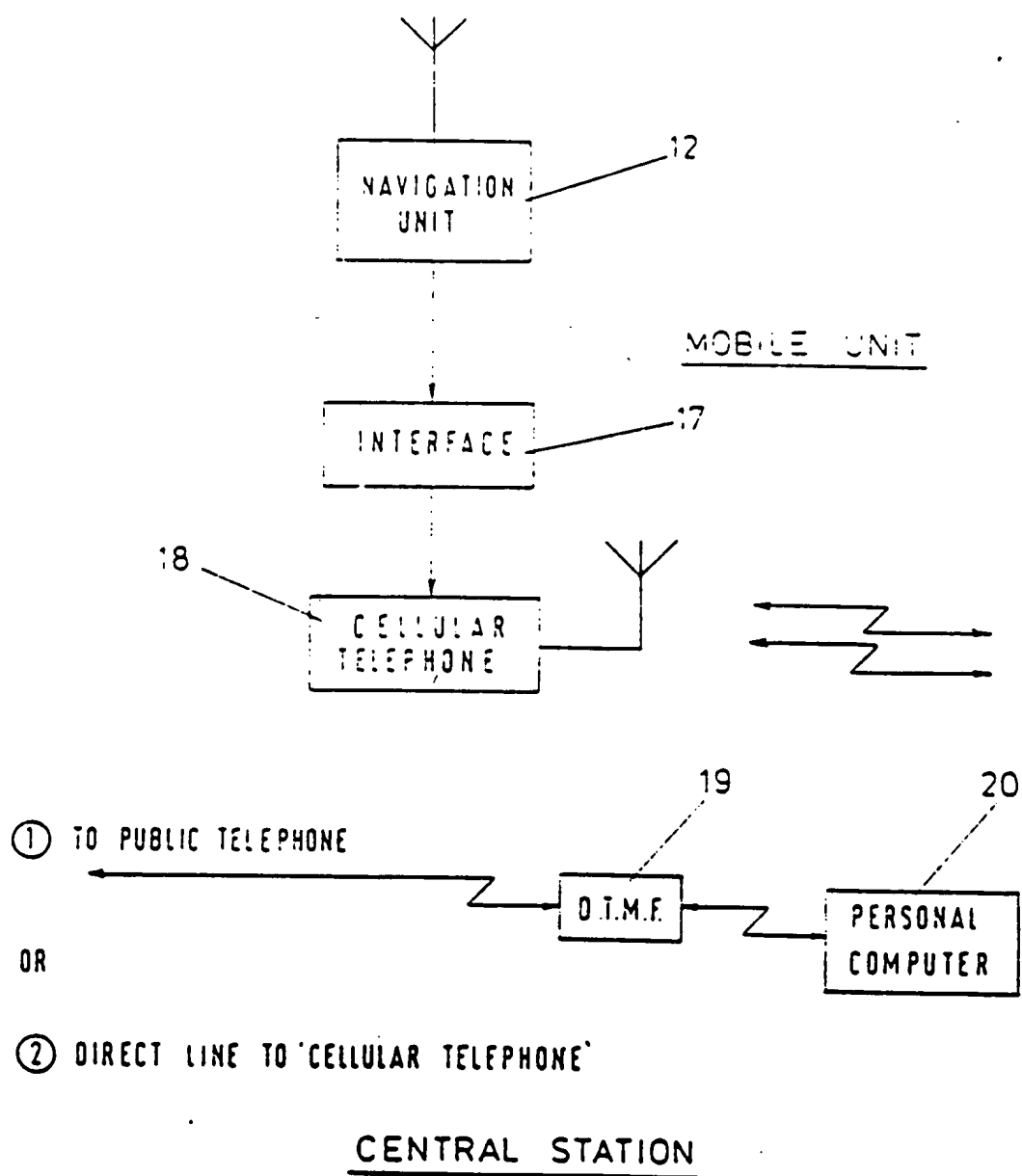
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FIG. 1

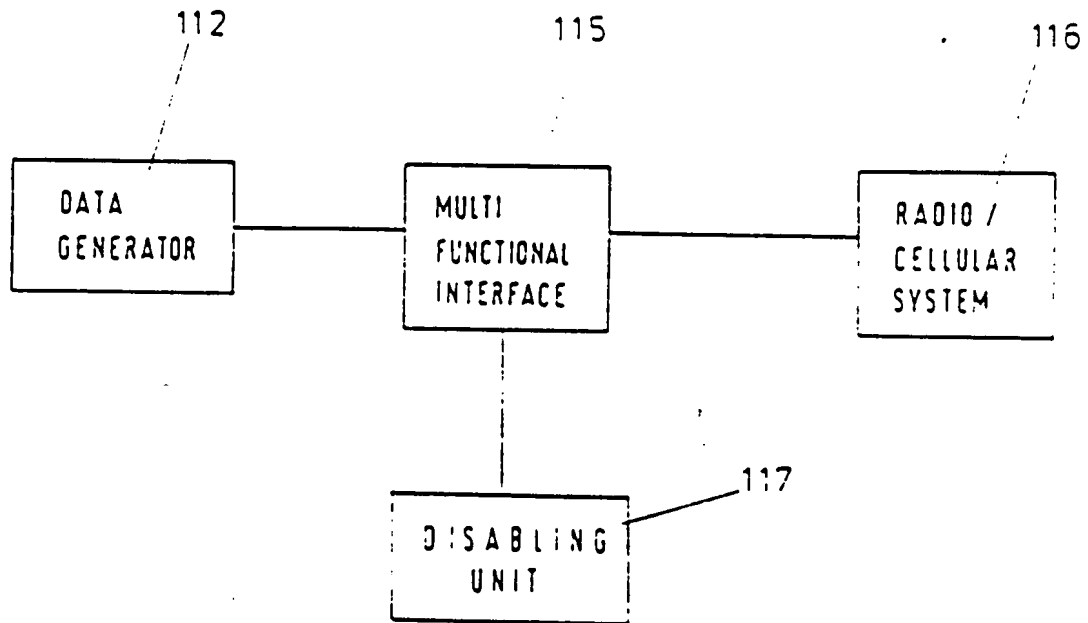
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FIG. 2

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FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 89/00471

I. CLASSIFICATION OF SUBJECT MATTER (Inventor's classification symbols should indicate only) According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : G 01 S 5/02, G 06 G 1/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
IPC ⁴	G 01 S, G 06 G, H 04 Q	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, " with indication, where appropriate, of the relevant passages "	Relevant to Claim No. 1
X	EP, A, 0042099 (ADVANCED STRATEGICS, INC.) 21 October 1987, see the whole document --	1-5, 7-9
X	FR, A, 3541801 (AERAC Sacl) 31 August 1984, see the whole document --	1-5, 7-9
A	US, A, 4596983 (WANKA) 24 June 1986, see the whole document --	1
A	US, A, 4651186 (MARTINEZ) 17 March 1987, see the whole document --	1-3
A	EP, A, 0199266 (SIEMENS AG) 29 October 1986, see the whole document --	1-3
A	Wescor Technical Papers, vol. 20, 1973, paper no. 20/4 (Hollywood, US), J.S. Bravman et al.: "Automatic vehicle monitoring", pages 1-10, see the whole article --	1-3
<p>* Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the invention but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of the International Search Report	
8th September 1989	11 Oct. 1989	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	T.K. WILLIS	

PCT TO 19 11171

DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)			
Classification	Number of Document	Date of Publication	Page(s)
X	EP, A, 0103860	BRITISH TELECOMM 31 October 1984, see the whole document	1-3,7-9
X	US, A, 4631187	FORAY et al. 17 March 1987, see the whole document	1-3,7-9